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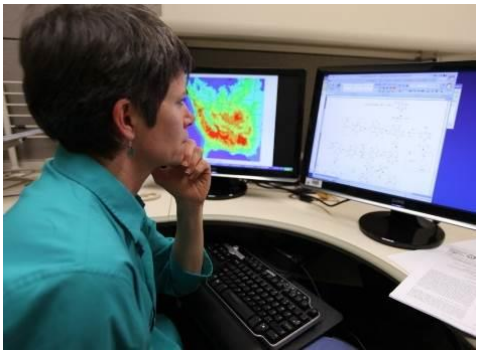
Strategic Plan for the ORD National Exposure Research Laboratory (NERL)



Office of Research and Development
National Exposure Research Laboratory (NERL)

Laboratory Director's Introduction

The National Exposure Research Laboratory (NERL) has a valued reputation for supporting the Agency's mission of protecting human health and the environment with multidisciplinary expertise that brings cutting-edge research and technology to address critical exposure questions and to develop approaches for reducing harmful exposures. I am pleased to present this strategic plan that outlines who we are as an organization – our mission, our values, our goals, and our direction for the future.

The plan was developed after much discussion among NERL's management team and with input from across the Laboratory. Our plan flows from EPA's Strategic Plan and NERL's Exposure Framework. It emphasizes the science and capabilities we bring to each of ORD's research programs, and highlights when we have opportunities to collaborate across ORD as well as the broader Federal and scientific research community. I am excited about leading this respected and dynamic organization as we implement our plan. While the Strategic Plan provides a compass for the next five years, a companion document, NERL's Action Plan, provides the road map with details about the approaches that will be employed over the next one to two years to ensure that NERL and its scientists continue to be internationally recognized for exceptional contributions to exposure research science.

Jennifer Orme-Zavaleta, PhD
Director, ORD National Exposure Research Laboratory

NERL Strategic Plan

Who We Are

EPA's National Exposure Research Laboratory (NERL) was created in 1995, when the Office of Research and Development (ORD) reorganized to better support EPA's mission of protecting human health and the environment. This mission driven reorganization created national laboratories focused on exposure, effects, and risk management research, and, centers focused on risk assessment, and environmental research. NERL was strategically positioned to provide exposure science leadership not only to EPA and across the Federal government, but to the broader scientific community on emerging exposure science challenges. ORD has continued to evolve since 1995, most recently realigning its research programs to focus on conducting research using a systems approach in an integrated and transdisciplinary manner and transitioning to sustainability as an organizing driver. NERL also continues to evolve organizationally and scientifically in driving the development, understanding, and application of exposure science. NERL's multidisciplinary expertise enables the laboratory to bring innovative research and technology to address critical exposure questions and to develop approaches for reducing exposures which are necessary to protect human health and the environment.

[1]

Headquartered in Research Triangle Park, N.C., NERL has an in-house workforce of more than 300 scientists, engineers and staff across six divisions in four locations: RTP; Cincinnati, Ohio; Athens, Georgia; and Las Vegas, Nevada.

NERL's Mission and Core Values

We pursue our mission guided by a set of core values that ensure the integrity and quality of the science support that we provide to our partners. We strive to be collaborative in all that we do and responsive to the short term and long term needs of our partners, EPA and the American people. Our core values include:

The mission of the U.S. EPA's National Exposure Research Laboratory (NERL) is to carry out EPA's mission to protect human health and the environment by developing and applying innovations in exposure science.

NERL is a professional organization. We lead by example, and practice and model honesty, integrity, transparency, respect, and professionalism. Scientific and management integrity serves as an umbrella guiding our operations and conduct. We strive to become a highly desirable place to work not only for the excellence of our science, but also for the high quality of our workplace.

[1] Word cloud generated using Tagxedo.com

NERL is an innovative organization. We bring innovation, sustainability, and systems-thinking to solve high-priority environmental problems faced by the Agency. We strive to improve our own knowledge and expertise, and to recruit and collaborate with similarly high levels of expertise. We also recognize the important contributions of our staff, and celebrate our successes.

NERL is a recognized leader in exposure science. We work towards being a world-class laboratory. Our mission of producing and applying leading-edge, high quality exposure science requires us to be amongst the world's leaders in exposure science. We understand the importance and value of exposure science in solving the Agency's challenges. We look at problems from an exposure perspective, and blend our expertise with that of our colleagues in other parts of ORD to generate innovative solutions to problems. We conduct our work with scientific integrity, incorporating appropriate levels of peer review and quality assurance to ensure the highest quality of science.

NERL is an impactful organization. We conduct research and deliver results that are relevant, timely, and responsive to stakeholder and partner needs. We translate and communicate the results of our research in a way that ensures their appropriate application.

NERL is a corporate organization. NERL is a National Laboratory that collaborates across organizational boundaries at all levels, forming partnerships, and focusing on maximizing value to the American people. We recognize the importance of our role in ORD and in EPA, and in our relationships with other Labs, Centers, and Offices as well as with Program and Regional offices.

Our Strategic Plan

NERL's Strategic Plan flows from EPA's 2014 – 2018 Strategic Plan and builds on the five overarching goals and four cross-Agency strategies identified by EPA's Administrator to organize and guide the priorities of the Agency over the coming years. In addition, the NERL Strategic Plan aligns with the ORD Strategic Research Action Plans that also flow from the overarching EPA goals and strategies *(Figure 1*). As a result, this Plan presents the scientific and organizational directions for NERL for the next five years (2014 to 2018) and the internal and external drivers that will influence our progress.

Figure 1: NERL's Strategic Plan and Action Plan flows from the EPA Goals and Cross-Agency Strategies

NERL's Strategic Plan identifies where NERL will make the most significant contributions to EPA's goals and how will we use the cross cutting, multi-disciplinary approaches to achieve those goals. A NERL Action Plan will be developed as a companion piece to this Strategic Plan. That Action Plan will identify the resources, people and guidance needed to implement our plan.

Organizational Goals

NERL's broad organizational goals for the next five years are identified below. NERL's goals encompass EPA's five Strategic Goals as well as the Agency's four Cross-Cutting Strategies. Our goals are designed to cover the whole array of what is required to achieve our mission of developing and applying leading-edge exposure science in support of EPA's mission to protect human health and the environment. We will continue to:

- **Maximize our impact through focus and scientific excellence:** Science is the foundation for high quality decision-making at EPA in order to safeguard human health and ecosystems from environmental stressors. The strength of that foundation rests largely on the strength and recognition of our scientific excellence. The breadth of challenges is daunting, so we must focus on key strategic areas in order to make a difference. Thus we will maximize our impact on EPA's work by delivering and communicating science that is consistent with the highest levels of scientific creativity, innovation, and integrity, and which is tightly focused on the most important Agency science priorities as identified in the EPA Strategic Plan and captured in ORD's Research Programs.

- **Evolve our organizational ability to solve complex, dynamic environmental challenges:** EPA has come a long way since 1970 in addressing environmental challenges. The challenges remaining today — climate change, computational risk assessment, sustainability — are in many ways bigger and more complex problems requiring ever-more sophisticated approaches. Sophistication does not necessarily mean more complex. We need to be more strategic in how we approach these challenges. It may mean more adaptive or more innovative, resting on a different way of defining and solving a problem. We will find ways to become more nimble, efficient, and effective at anticipating and addressing these increasingly complex and constantly changing priorities.

- **Become a High-Performing Organization:** Consistent with the Cross-Cutting Strategy identified in EPA's Strategic Plan and with ORD's Principles, we will attract and maintain a diverse and engaged workforce; develop a more collaborative and transparent work environment; modernize our business practices; take advantage of new tools and technologies; and ensure that we add value in every transaction with staff and work colleagues, partners, and EPA clients.

- **Be recognized as world leaders in exposure science for the 21st century:** The mission of developing and applying leading-edge science implies that we are world leaders in that science. Leadership in a scientific field is not conferred upon us by ourselves or by EPA; it has to be earned, by driving the field at such a high level that others outside EPA working in the same field are aware of and recognize our contributions as outstanding. Achieving this recognition is key to maximizing the impact of our science.

Exposure Science – What We Do

Exposure science is a relatively young discipline. In its simplest form, exposure occurs when a stressor contacts a receptor. Exposure science attempts to describe the real-world inter-relationships between stressors and receptors. The initial focus of exposure was on human health but the concept of exposure has since been extended to include ecological exposures taking place in the context of an ecosystem. Exposure science is a multidisciplinary systems science that describes and connects processes responsible for fate and transport of stressors as they move from sources to impact receptors in organisms. A description of environmental systems and populations in those systems requires linking many processes and must rely upon input from many disciplines. Additionally, maximizing the value and contributions of exposure science in solving environmental problems requires partnerships with other disciplines.

Recognizing the need for a prospective examination of exposure science, NERL, in partnership with the National Institute of Environmental Health Sciences, requested the National Research Council (NRC) to perform an independent study to develop a long-range vision for the next 20 years, as well as a strategy for implementing that vision. As a result, the NRC published the report *Exposure Science in the 21st Century: A Vision and Strategy* (2012),[2] which describes scientific and technologic advances needed to support the long-range vision for exposure science in the 21st century (*Figure 2*). The concepts, goals and objectives discussed in this report underpin the important role exposure science plays in the risk-based decision framework and the sustainability framework and thus, support the key role of NERL research as EPA moves forward into the future.

Faced with these complex problems, exposure science simplifies the problem by bringing the issues into focus and sets the context to guide the rest of the research and risk assessment that needs to be conducted, as well as the effectiveness of mitigation on reducing exposures and thereby risk.

NERL's Expertise in Pursing Exposure Science Advances

NERL's staff are among the leading exposure science experts in the world. Their dedication and expertise has supported EPA in moving forward to put in place the programs and regulations that help to create and sustain a healthy environment for all Americans. While our staff has a broad array of skills and specialties, they also comprise a cadre of environmental professionals that offer unique expertise in a number of areas that, combined with scientists across ORD, enable ORD to answer questions and solve environmental problems that few other organizations can address. NERL's primary areas of scientific expertise include fundamental skills in analytical/monitoring methods and exposure modeling. NERL's unique contributions to exposure science comes from the targeted application of these skills in several areas in support of EPA's mission. These fundamental skills and targeted applications are described as:

[2] National Research Council. 2012. Exposure Science in the 21st Century: A Vision and a Strategy. The National Academies Press, Washington, D.C.

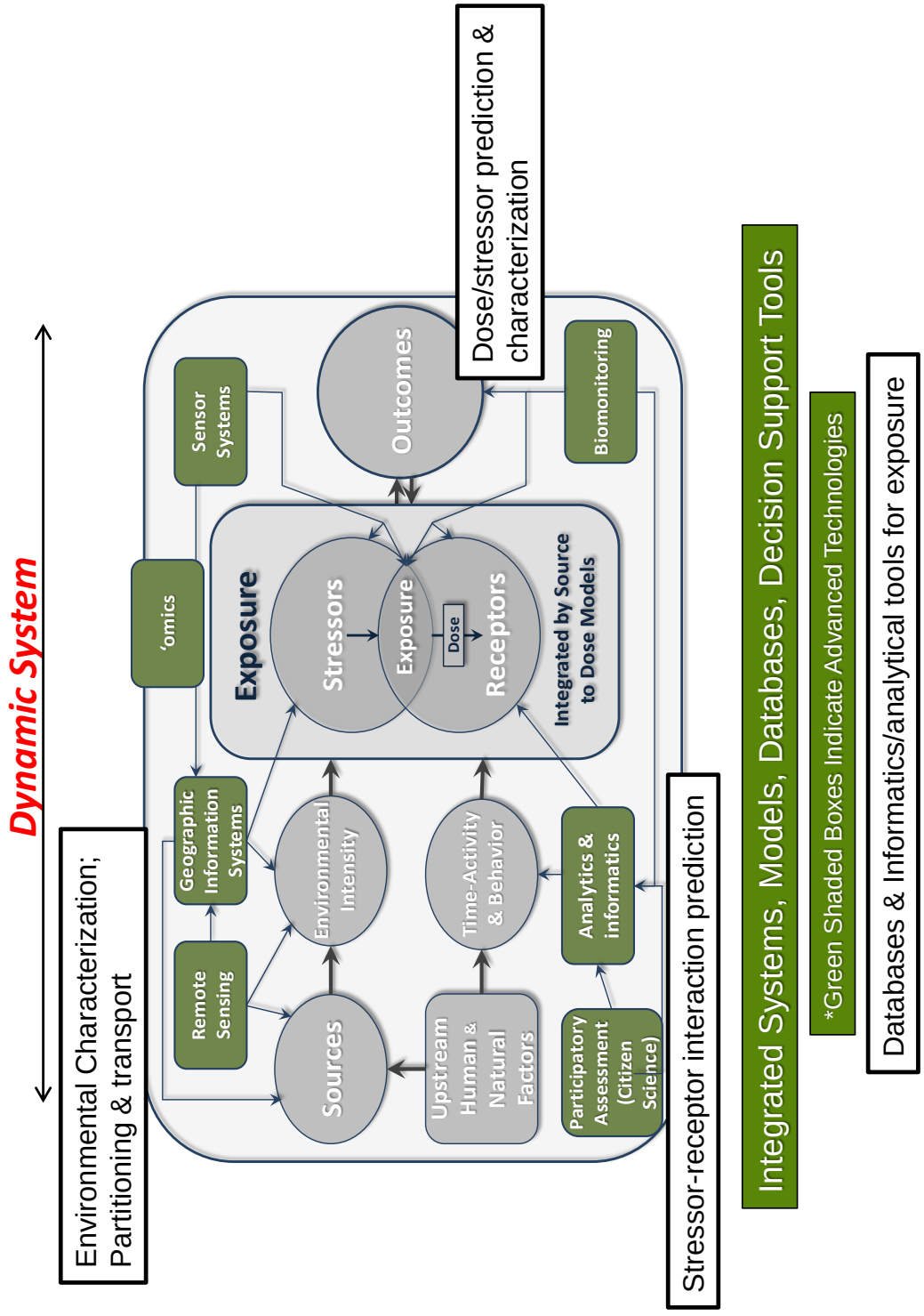


Figure 2: Illustrates how NERL's research maps to the NRC Conceptual Model for Exposure Science in the 21st Century (NRC, 2012)[2]

[2] Ibid., 4.

Fundamental Skills

- **Analytical/Monitoring Methods Development and Applications:** Research either in the laboratory or the field that will be used to develop, refine, or evaluate tools to quantify, measure, or sample stressors.

- **Exposure Modeling:** Research to develop, evaluate, and apply models to characterize the environment, the movement of human and ecological receptors in the environment, and interactions of environmental stressors and receptors.

Targeted Applications

- **Indicators/Indices of Exposure:** Research to determine how to combine measurements, data, and/or models in a way that succinctly describes or characterizes the state or change of exposure.

- **Exposure/Dose Process Characterization:** Primarily hypothesis driven research (including field studies, laboratory studies, and data analysis) that is conducted to gain knowledge about fate and transport, exposure, and dose in real world. This niche includes collection of data to elucidate the important processes in models, inputs to models, and data to evaluate models. This research is applied to both human and ecological systems.

- **Decision Support Tools:** Research activities to assemble data, analytical and predictive tools, and translate knowledge into a useable format for analysts and decision makers.

- **Predictive Modeling:** Research to develop, evaluate, and apply first principle, statistical, or stochastic models. This includes models for environmental characterization, exposure and dose, and mechanistic elucidation.

- **Source Apportionment/Environmental Diagnostics:** Outcome driven research where source apportionment or environmental diagnostic tools are developed and applied in real world instances to identify important stressors, sources, and pathways of exposure. Development of the measurement methods are captured in other categories; application of methods in field studies is captured here; along with model or tool development.

Transitions in Research Approaches

The methods NERL uses within the areas of expertise identified above are expanding and transitioning with the development of new techniques, instrumentation, and approaches *(Figure 3*). Examples of these transitions include:

- moving beyond gathering data, to an emphasis on exploring novel data sources and analyzing big data from disparate sources;
- moving beyond direct measurements in the laboratory or field, to use of 'omics,' sensors, and computational methods for predicting measurements;

- moving beyond stand-alone empirical models, to include integrated systems predictive models; and
- moving beyond targeted chemical exposure modeling, to include high throughput computational exposure analysis.

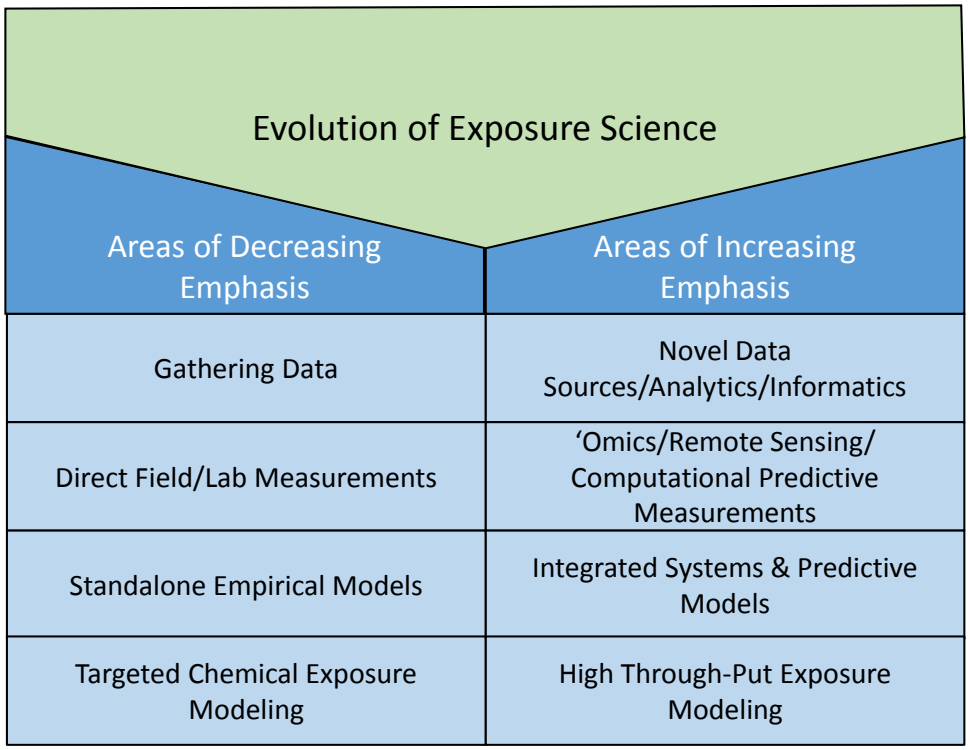


Figure 3: Illustrates the transitions in NERL's research and how Exposure Science is evolving with traditional and new research approaches.

Challenges of a Changing Environment

NERL faces a number of challenges over the coming years. One of the main purposes of this Strategic Plan is to lay out how NERL will remain an effective and high performing organization in a rapidly and constantly evolving environment. We need to be nimble, and anticipate or adapt as appropriate to changes. Collaborations and partnerships will be key in leveraging our resources and enhancing our workforce. The following are some of the major drivers that must be considered:

Changes within ORD: ORD has recently adopted a balanced matrix approach to research planning and implementation where National Program Directors are responsible for identifying and prioritizing the Agency's environmental problems to be addressed, and the Laboratory's primary role is to understand these problems and develop innovative research that is timely and responsive to solving these problems.

Changes to the exposure science "problem space": Although our focus remains exposure science, the problems to which we are applying our expertise are ever more complex and interdependent. Solving such problems requires different innovative approaches to solutions, and approaches that incorporate concepts such as transdisciplinary, systems-thinking, and a sustainability orientation.

Changes in our resource base: At present, the resources (dollars, people, equipment, facilities) available to ORD are declining. This trend is likely to continue, at least for the near term. Implications for NERL are that we will need to focus our resources on the highest priority Agency problems and be as efficient and effective as possible to maximize our impact.

Changes to our workforce: The NERL workforce is the most important asset to ensure our future success. They are the key to maintaining our position as a high performing organization. With the increased complexity of the Agency's needs, evolving research priorities, and the rapid developments in exposure science, NERL must help our scientists and staff acquire the skills necessary to assist the Agency in solving the nation's pressing environmental problems. We will develop a workforce strategy for acquiring and evolving the skills needed to ensure that we continue to define the cutting edge of exposure science in addressing Agency priorities working within the bounds of a resource constrained environment.

The Road Ahead

The concepts presented in NERL's Strategic Plan are the foundations for NERL's future, long-term planning. The companion Action Plan, which will be updated annually, emphasizes NERL's long-term priorities:

- Community Engagement/Citizen Science
- Data Collection & Management
- Models
- Sensors/Dosimeters
- Computational Exposure
- Partnerships

Together, the strategic and action plans provide a common vision, and concrete steps for supporting EPA's mission to protect human health and the environment by developing and applying innovations in exposure science. We will be successful in our endeavors by embracing NERL's common values; focusing our research and capitalizing on scientific capabilities; and by embracing NERL's organizational goals.

This document is a product of considerable discussion and input from across the Laboratory. The success of our organization in meeting EPA's and NERL's mission depends on each member of the Laboratory. Together, we can apply exposure science to protect human health and the environment.

References for Additional Information

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